it was abnormally heavy in the Rocky Mountain area and in most of California. Other sections had generally normal or near normal amounts. Snowfall was unusually heavy from the Potomac Valley southward into Virginia and North Carolina.

Near the end of the month the snow cover in the eastern half of the country extended as far south as central or southern Georgia, Alabama, and Mississippi. The cover was fairly heavy in portions of the upper Mississippi and Ohio River Basins, the Potomac and James River Basins and in northern New England. In the far West, mountain snowfall was still deficient in much of Arizona, New Mexico, Nevada, and portions of Montana and Washington.

Ice in the rivers was heavy in most northern and eastern districts with ice covering most of the Ohio River and floating ice persisted in the Mississippi south of Helena, Ark. It was reported that the Cumberland River was entirely frozen over at Nashville, Tenn. The Delaware and Susquehanna Rivers were frozen over the entire month with the ice varying in thickness from 10 to more than 20 inches near the end of the month. At Washington, D. C., above Key Bridge, the ice in the Potomac River measured 12 to 15 inches. Some gorging of ice occurred, principally in the Ohio River, but did not reach any serious proportions. The main difficulty was from hindrance to navigation.

Minor rises occurred in a few rivers during the month but flood stage was reached, or exceeded, only at Clyo, Ga., on the Savannah River, crest 12.2 feet on the 26th; at Blountstown, Fla., on the Apalachicola River, crest 15 feet on the 18th; and at Lock No. 3 on the Tombigbee River, crest 34.5 feet on the 17th. No damage was reported.

Heavy precipitation occurred over the Sacramento Basin, during the month, in contrast to the scanty rainfall over this area during the preceding months of this season. The total monthly rainfall for Sacramento, Calif., was 7.98 inches, the highest of record for any January since 1916. There was a heavy overflow into all bypasses, although flood stage was not reached at any of the reporting stations. The only known damage was from the flooding of about 2,700 acres in the Yolo Bypass, on the 12th, where a total loss of about $57,500, mostly of grain land, was reported.

Abnormally low stages prevailed at a few points, principally in the Mississippi River. The river stage at St. Louis, Mo., on January 16, —6.1 feet, is the absolute lowest stage of record (1861–Jan. 31, 1940); the previous lowest stage was —5.5 feet on December 12 and 13, 1937. The low stage this year was not directly due to an ice gorge (unlike the low stage in December 1937) but to the low volume of water and was only indirectly affected by ice conditions above.

Table of flood stages during December 1939 and January 1940

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
	Feet			*Feet*	
ATLANTIC SLOPE DRAINAGE					
Savannah: Clyo, Ga.	11	Jan. 23	Jan. 28	12.2	Jan. 26
EAST GULF OF MEXICO DRAINAGE					
Apalachicola: Blountstown, Fla.	15	Jan. 18	Jan. 18	15.0	Jan. 18
Tombigbee: Lock 3 (Whitfield, Ala.)	33	Jan. 15	Jan. 18	34.5	Jan. 17
WEST GULF OF MEXICO DRAINAGE					
Trinity: Liberty, Tex.	24	Dec. 26	Dec. 27	24.3	Dec. 27
PACIFIC SLOPE DRAINAGE					
Columbia Basin					
South Yamhill: Willamina, Oreg.	8	Dec. 15	(1)	9.6	Dec. 16

[1] No record.

WEATHER ON THE ATLANTIC AND PACIFIC OCEANS

[The Marine Division, I. R. TANNEHILL, in charge]

NORTH ATLANTIC OCEAN, JANUARY 1940

By H. C. HUNTER

Atmospheric pressure.—The average pressures were considerably lower than normal from the waters adjoining eastern Canada and the northeastern United States east-southeastward to southwestern Europe and adjacent Africa. The deficiency at Horta, in the Azores, was 7.9 millibars. Near southern Greenland, however, there was a marked excess, and over the northern Gulf of Mexico a moderate excess. The first 10 days over middle and higher latitudes brought lower pressures on the average than the remainder of the month.

The extremes of pressure in available vessel reports were 1,035.6 and 962.2 millibars (30.58 and 28.41 inches). The higher reading was noted on the American steamship *Cities Service Boston* during the forenoon of the 7th near the Chesapeake Capes. On land the New Orleans station noted a like reading on the 25th, and the Julianehaab station an even higher one on the 15th and 16th. The low mark was read on the Danish steamship *Svanhild*, near 45° N., 47° W.; the day was the 7th, as with the high mark, while the hour was noon. Table 1 shows that a slightly lower reading was made at Belle Isle, near northern Newfoundland, on the 4th.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Atlantic Ocean and it shores, January 1940*

Station	Average pressure	Departure	Highest	Date	Lowest	Date
	Millibars	*Millibars*	*Millibars*		*Millibars*	
Julianehaab, Greenland [1]	1,005.6	+9.0	1,041	15, 16	971	6
Lisbon, Portugal	1,016.1	−4.9	1,026	26, 27	999	2
Horta, Azores	1,013.4	−7.9	1,029	20	993	1
Belle Isle, Newfoundland [2]	1,001.1	−6.0	1,039	14	980	4
Halifax, Nova Scotia	1,011.8	−3.4	1,033	14	990	2
Nantucket	1,013.9	−3.4	1,033	10	999	15
Hatteras	1,018.0	−2.7	1,032	10	989	24
Turks Island	1,016.5	−1.1	1,019	7-9, 11, 28	1,012	10, 29
Key West	1,019.0	−0.3	1,030	28	1,012	23
New Orleans	1,022.7	+2.4	1,036	25	1,005	14

[1] For 24 days.
[2] For 26 days.

NOTE.—All data based on a. m. observations only, with departures compiled from best available normals related to time of observation, except Hatteras, Key West, Nantucket, and New Orleans, which are 24-hour corrected means.

Cyclones and gales.—So far as reports show, the month was somewhat less stormy over the North Atlantic than the average January, but it was considerably stormier than the preceding December.

Three LOWS are particularly noteworthy. The earliest was over the central Lake region on the morning of the 5th, with an accompanying secondary over the north-

eastern Gulf of Mexico. These LOWS rapidly advanced and joined as one cyclone at approximately 41° N., 61°W., within 24 hours and this moved to 45° N., 44° W., in another 24 hours. Thence the storm turned toward the north-northeast. Numerous reports of gales due to this LOW have been received and the lowest Atlantic vessel barometer reading, mentioned above, was noted near its center.

The next of the important storms was located over Michigan on the evening of the 14th and near northeastern New England on the morning of the 16th, after which it moved slowly northward. Among reports of high winds noted in connection with this LOW was one of hurricane force (12) met by the U. S. cutter *Cayuga* some distance east of the Maine coast. A veteran vessel captain of Chesapeake Bay rated this storm as the worst experienced in 35 years. The Italian steamship *Fidelitas*, from Casablanca bound for New Orleans, suffered so much injury between Hatteras and Bermuda that the captain turned into Norfolk for repairs.

The third intense storm apparently developed over the western Gulf of Mexico, where its center was noted on the 22d, about 200 miles east of Tampico. The morning of the 23d found this storm over northwestern Florida. The British schooner *Gloria Colita*, which had left Mobile bound southward, on the 21st, was found many days later unmanned and greatly damaged, presumably from encountering the high winds of this cyclone.

By the morning of the 24th the storm was central near Cape Hatteras, very intense, and affecting a large ocean area. Chart XIV indicates the conditions of 7 a. m. (E. S. T.) of that date. The American steamships *Cities Service Koolmotor* and *Henry S. Grove* met winds of hurricane strength off the middle Atlantic coast of the United States this day. The Finnish steamship *Olovsborg*, out from Norfolk the 22d for the Panama Canal and Japan, lost one member of the crew while four others suffered severe injuries, and all the lifeboats were lost, so the vessel returned to Norfolk for extensive repairs. The LOW moved rapidly out to the east-northeastward after the morning of the 24th, but intense winds were noted to and somewhat beyond the 60th meridian.

Elsewhere in this REVIEW is mention of some features of norther weather met on the 19th and 20th over the south-central Gulf of Mexico by the American steamship *Antinous*.

Snow squall over Gulf of Mexico.—At about the same time as the norther just mentioned, a fall of snow, lasting about half an hour, was noted off the southeastern coast of Louisiana, in a latitude where snow at sea is of very unusual occurrence. The vessel was the American steamship *Walter Jennings*, Charles Warner, master, bound from Key West to Galveston. The position and time of the snowfall were about 28° N., 91° W., January 20, 10 a. m.

Ice in coastal waters.—In the harbors, navigable rivers, bays, and sounds of the eastern coast of the United States, as far south as North Carolina, vessels had much trouble with ice during the month, particularly during the second half.

Fog.—Over the main part of the North Atlantic there was exceedingly little fog, as far as reports now at hand indicate. The Grand Banks region seems to have had fog on but 1 day, the 20th, and then over only a small portion. Similarly, near the coast of the North American continent from Nova Scotia to Sandy Hook reports show but little fog.

To southward of Sandy Hook, the waters near the coast, as far as Galveston Bay, had almost everywhere more fog than usual. Observers on many vessels, particularly near the coasts of the Carolinas, commented on the connection between this fog and the great temperature contrast between the very cold air coming from over the continent and the warmer air close to the sea water, especially the water of the Gulf Stream. Several observations mention the fog as only low-lying.

While the fog was rather well distributed as to area near the coasts of the Middle and South Atlantic and Gulf States, save that there was little near Florida, there was irregularity in time distribution. Unusual frequency was evident during the days 12th to 19th, inclusive, and there was scarcely any before the 6th or after the 27th.

Two of the 5°-squares, 25° to 30° N., 90° to 95° W., and 30° to 35° N., 75° to 80° W., had fog on 10 days each, the greatest number of any North Atlantic squares. To the northeastward, the square 35° to 40° N., 70° to 75° W., furnished fog reports on 9 days.

OCEAN GALES AND STORMS, JANUARY 1940

Vessel	Voyage		Position at time of lowest barometer		Gale began January	Time of lowest barometer, January	Gale ended January	Lowest barometer	Direction of wind when gale began	Direction and force of wind at time of lowest barometer	Direction of wind when gale ended	Direction and highest force of wind	Shifts of wind near time of lowest barometer
	From—	To—	Latitude	Longitude									
NORTH ATLANTIC OCEAN			° ′	° ′				*Millibars*					
Exhibitor, Am. S. S.	Gibraltar	New York	36 12 N.	17 54 W.	1	5a, 2	3	993.9	SW	W, 7	NW	SW, 10	SW-W.
Frode, Dan S. S.	Norsundet	Albany	44 23 N.	61 00 W.	2	8a, 2	4	994.3	W	W, 3	W	WSW, 10	
Winkler, Pan. M. S.	Antwerp	New York	37 12 N.	57 36 W.	2	8a, 2	2	996.3		SW, 10		SW, 11	
Ipswich, Am. S. S.	Lisbon	do	38 42 N.	52 42 W.	2	2p, 2	2	989.2	SSW	SW, 10	WNW	SW, 10	SW-W.
Alexandre Andre, Belg. M. S.	Ghent	Aruba	44 36 N.	20 18 W.	2	6p, 2	3	981.4	NNW	W, 6	WNW	NW, 10	SW-NW.
Winkler, Pan. M. S.	Antwerp	New York	38 00 N.	60 00 W.	4	8a, 4	5	1,006.1		W, 8		W, 10	
Edam, Du. S. S.	do	do	45 36 N.	45 53 W.	2	4a, 5	5	978.2	SSE	W, 9	WNW	W, 9	SW-W.
Svanhild, Dan. S. S.	Kirkwall	Boston	48 21 N.	41 50 W.	3	10a, 5	6	965.6	S	WSW, 8	WNW	W, 10	WSW-WNW.
Aurora, Am. M. S.	Beaumont	New York	36 38 N.	74 13 W.	5	8p, 5	6	1,008.5	NW	W, 5	NW	NW, 10	W-NW.
Meanticut, Am. S. S.	Gibraltar	Baltimore	34 40 N.	61 50 W.	6	4a, 6	7	996.6	SSW	SSW, 9	NW	WNW, 10	SSW-W.
Ipswich, Am. S. S.	Lisbon	New York	39 00 N.	61 18 W.	6	1p, 6	7	984.4	SSW	NW, 11	N	NW, 11	WNW-NW-W.
Alexander Hamilton, U. S. C. G.	On patrol out from Norfolk.		41 00 N.	62 06 W.	6	1p, 6	7	988.2	NNW	NNW, 2	NNW	NW, 9	
Bronxville, Nor. M. S.	Gibraltar	Boston	32 53 N.	54 07 W.	5	4p, 6	7	1,002.0	WNW	SW, 9	NNW	W, 11	SW-NNW.
Alberta, Ital. S. S.	do	New York	33 00 N.	63 00 W.	6	4p, 6	7	1,006.3	WSW	W, 9	NW	W, 10	WSW-W.
Express, Am. S. S.	Lisbon	do	39 56 N.	58 30 W.	6	6p, 6	7	978.7	WSW	NW, 11	NW	NW, 11	W-NW.
Royal Arrow, Am. S. S.	New York	Beaumont	28 55 N.	92 10 W.	6	8p, 6	6	1,014.6	N	NE, 4	N	N, 10	NE-N.
Svanhild, Dan. S. S.	Kirkwall	Boston	45 04 N.	47 05 W.	7	12m, 7	9	962.2	N	N, 3	NE	NNW, 11	
Rotterdam, Du. M. S.	New York	Amsterdam	46 18 N.	37 42 W.	7	10p, 7	8	972.9	SW	SW, 9	SW	SW, 10	None.
City of Savannah, Am. S. S.	do	Savannah	33 35 N.	77 14 W.	7	4a, 8	8	1,008.5	SSE	WSW, 6	WSW	SSE, 10	SSE-WSW.
Exhibitor, Am. S. S.	Gibraltar	New York	37 42 N.	33 18 W.	7	3p, 8	8	992.9	S	S, 8	W	S, 10	S-SW.
Exochorda, Am. S. S.	do	Boston	42 50 N.	38 12 W.	10	2p, 10	10	988.2	SSE	SSW, 9	WNW	SSW, 9	S-W.
Katrine Maersk, Dan. M. S.	Copenhagen	Port Arthur	51 54 N.	25 06 W.	11	10a, 11	11	1,002.7		SSW, 9		SSW, 9	
Gulfpenn, Am. S. S.	Baltimore	Corpus Christi	26 48 N.	91 42 W.	14	4p, 13	14	1,006.8	NNW	S, 3	NNW	NNW, 8	
Burgerdijk, Du. S. S.	Rotterdam	New York	48 30 N.	41 43 W.	15	6a, 15	15	992.8	NNW	WNW, 9	SSW	NNW, 9	ENE-NNW-WSW.

See footnotes at end of table.